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Agricultural Memorandum No. 314

Orchard Trials in Kent, Hampshire and West Sussex in 1969

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Introduction

This Memorandum follows up Agricultural Memorandum No. 267 which detailed results obtained in orchard trials in 1968, with some comparison between that year and 1967. The general aims of the work were discussed in the Memorandum, and Appendix I described the sites and instrumentation, and reference should be be to it for these details: the minor changes introduced in 1969 are listed below. The sites involved were at Leckford (orchards 4, 5 and 6), Framptons, Chichester, Sussex, (orchards 1 and 4), Mockbeggar, Kent, (orchards 1 and 2) and Stelling Minnis, Kent, (High Chimneys and Leigh Barton).

Changes in 1969

The changes in meteorological coverage have been:

(a) to eliminate the 1' earth thermometers and raingauges in the light of earlier results, and

(b) to introduce a temperature reading at the lowest point (in the dip) in orchard 6 at Leckford.

The night minimum temperature in the Leckford dip was read from a minimum thermometer exposed in a cocoa-tin mount, and to ensure strict comparability a similarly mounted thermometer was placed beside the sreen in the standard Leckford 6 position. This was done to investigate the suspicion that more damage was being done to the fruit in the lowest position in this orchard than in the vicinity of the screen used in previous years.

Meteorological Data

The data available included daily run of wind, maximum, minimum and 0900 GMT temperature readings at each site, and a brief indication of weather and wind direction at each 0900 GMT observation. Generally, the observations were of a high standard and the only missing records consisted of two days at Chichester, a month's gap in maximum temperatures (broken thermometer) at Leigh Barton and a few days of somewhat unreliable readings (during the fireblight scare) at Stelling Minnis in late May; an attempt has been made to make good some of these gaps by estimate, and results must be interpreted with this reservation.

Analysis

Table I indicates the yield at the various orchards, the hours of frost and day maximum and 24 hour mean temperatures as a comparison between the years 1968-69.

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Table 1 - see end

It is perhaps interesting to discuss the 4 areas in relation to these results.

Leckford. The frost hours in the important period between bud burst and mouse ear were much less numerous in 1969 than 1968, and hours with severe frost (interpreted here as with a temperature of 28°F and below) were low - in fact hours of severe frost in 1968 are almost the same as of total frost in 1969. The mouse ear stage occurred about 5 days later in 1969 than 1968 and subsequent frost was light at Leckford with only one hour of severe frost in the dip in orchard 6. Temperatures from 10% blossom to 10% petal fall were 4 - 6°F higher in 1969, but only in orchard 6 was there a real difference in the crop, which was much better in 1969. Possibly orchards 4 and 5 are near their optimum performance anyhow and possibly too the new trees in orchard 5 may have affected croppings.

Particularly interesting are the behaviour of night temperatures in the dip at Leckford 6 about 10 feet below the thermometer in use for the last two years. The overall difference in minimum temperatures between the two Leckford 6 positions was almost exactly zero but on nights when minimum temperatures fell below 40°F, the dip readings averaged 0.8°F colder, and on frosty nights the dip site was 1.0°F colder: the maximum difference was -3.0°F (in early April with a min. temperature of 28°F) and the biggest difference in the opposite sense was +3.3°F (in mid-June with a minimum temperature of 48°F). This April difference would of course imply a temperature down to 25°F in the hollow.

Chichester. Both orchards showed improvement in yields on the 1968 figures, conspicuously so in Framptons 4. The two years were very different in frost before mouse ear, as Table 1 shows. Frost since mouse ear (which was at around the same date in both years) was about the same and the only occasion of severe frost in 1969 (only 1 hour, as recorded on Figure 1) occurred at Framptons 1; this was probably not significant as the two orchards cropped at the same level. Temperature differences between 1968 and 1969 in the blossom period were great, as at Leckford, espcially by day.

Mockbeggar. Orchard 1 on the slope cropped very similarly in both years, but orchard 2 on the flattish plateau did very much better. Mouse ear occurred early in April in both sites in a rather frosty period in 1968, and about a week later in 1969. Two frost periods followed, with two hours below 28°F in orchard 1 and one in orchard 2: orchard 1 performed the better, and a short period like this is probably not significant. Maximum and mean temperatures were almost indistinguishable between the two orchards and were higher than at any other orchard site and very much above the 1968 level.

Stelling Minnis. Yields of apples were a great deal better in 1969 than 1968, especially at Leigh Barton. The frost level in the period between bud burst and mouse ear was probably insignificant, but there were a few cold period afterwards, especially at Leigh Barton, which was a little earlier than High Chimneys for fruit development (Figure 1). Temperatures were virtually indistinguishable between the two areas (with the reservations of estimated temperatures in April and late May) but the positive difference between the temperature at Mockbegger and Stelling Minnis and the negative difference in apple yields suggested that meteorological difference played

/a

a small part in determining the yield level.

Accumulated Temperatures

These have been compiled for 1969 as day degrees above 50°F between the various stages and they are shown in Table II in which the orchards are now listed in order of performance.

Table 2 - see end

The data in this table can be compared with similar figures for 1968, given in Agric. Memo. 267 but for convenience the 1968 accumulations are shown in the last two columns. Several aspects of this table call for comment. The accumulations for Leckford for 1969 were less by 10-15 day degrees in total than in 1968, with a much shorter period between the two extreme fruit stages. At all the other localities the accumulations were much more in 1969 than in 1968 - the difference was as much as 77 day degrees at Framptons 1 and 58 at Framptons 2, in 9-12 fewer days. Similar but smaller differences are seen at the other two localities. The variability of stage this year from place to place is surprising; thus at Leckford, bud burst to mouse ear took 17-18 days, compared with only 6-9 days elsewhere and at Stelling Minnis and Mockbeggar, mouse ear to 5-10% blossom was 24-30 days compared with 15 days at Leckford. This seems strongly to suggest real (perhaps important) difficulties in defining these things objectively. If this is so, then the accumulated temperature totals are worth very little and indeed the variation between 40 and 93 from mouse ear to 10% blossom (and other similar variations) seems to prove this. The overall seasonal totals between first and last recorded fruit stages should, of course, show less variation, but differences already remarked of 77 exist between one year and another, and differences this year at different orchards of 77 (215 and 138) suggests that the accumulated temperature approach is to be treated with the greatest caution.

Wind

Analysis was made as in 1968 with the wind data. It was thought last year that the value of the observations was doubtful, partly because averaging over 24 hours masks details such as uniform lightness of wind by day, katabatic flow by night etc, and because one is not quite sure what is being measured within an orchard. Diagrams were drawn as before, showing the daily run of wind through the period, and also showing the daily run of wind from 10% blossom to full petal fall, and the latter is reproduced as Figure 2.

It is not perhaps worth while commenting in detail on this Figure, but it is of interest to note for example that the two high yielding orchards at Framptons, Chichester, were almost identical in crop, and showed up as the least windy in the range and as an average site.

It is interesting to list the stations in order of yield, and to consider them in relation to their order of windiness. This gives the order in 1968 of 4, 3, 5, 9, 7, 2, 1, 6, 8 and in 1969 of 7, 5, 9, 6, 2, 8, 1, 3, 4; in 1969 for example the seventh highest yielding orchard was High Chimneys, the windiest site, and the second windiest was Leigh Barton (which yielded comparatively well in 1969) and the least windiest Framptons 1; interestingly, although High Chimneys, which yields well was also windy in 1968, Leigh Barton (with a low yield) was not.

/Conclusions

Conclusions

At the end of three years experimentation it is impossible for the writers to spotlight any factor in which one might say that meteorological differences between the orchards could be related closely and recognizably with apple yields. Clearly, then, although macro-scale climate differences (for example between southern France and southern England) are almost certainly significant, meso-scale differences, as in these experiments, do not appear to be. A variability in susceptibility to frost however will usually be important, though this was not obvious in 1968 with Leckford at the same time being the frostiest place and the most prolific apple yielder: height, with consequent lower temperatures, is certainly relevant, and the effects are shown up in the broadly lower yields in both years at Stelling Minnis compared with Sussex. It is most unclear from meteorological considerations why Mockbeggar should yield so poorly.

It is felt that to perform experiments of this kind in future years will not produce more illuminating results, and that future progress can only be made in carefully controlled conditions of pollination and other factors. There must, as Powell and Waring pointed out, be comparative examinations of the weather for the previous 18-24 months, probably on an actual research station using electronic recording equipment.

References:

Hurst, G W and Cochrane J, 1969: Meteorological factors affecting cropping of Cox's Orange Pippin in Kent, Hampshire and West Sussex. Agricultural Memorandum No 267.

Powell, B H and Waring, A P 1969: Meteorological survey in three Worcestershire orchards 1968-69. Issued by N.A.A.S., West Midland Region, Wolverhampton.

Any comments or suggestions on this paper should be sent to the authors.

Meteorological Office
Bracknell, Berks.
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TABLE 1

ORCHARD YIELDS AND METEOROLOGICAL PARAMETERS IN 1968 AND 1969

Station		Yield of Apples			Frost: Bud burst to mouse ear		Temperatures 10% blossom to 10% petal fall			
							Average maximum		24 Hr. Mean	
		1969 Bushels	1968 Bushels	Percentage change	1969 Hours*	1969 Hours*	degrees Fahrenheit 1969	1968	1969	1968
Leckford	4	782	804	-3	16(1)	65(11)	63.3	56.9	55.7	48.4
	5	708	719	-1½	19(4)	66(15)	63.0	56.8	55.6	49.4
	6	543	431	26	23(3)	74(18)	63.1	58.2	53.4	49.3
Framptons	1	744	553	35	1(0)	34(7)	65.6	57.2	55.4	49.9
	4	747	230	225	0	42(8)	65.6	57.4	55.9	49.9
Mockbeggar	1	270	286	-½	0	9(3)	66.0	-	59.0	-
	2	320	175	83	0	11(3)	65.5	58.2	58.7	49.9
High Chimneys		520	250	108	2(0)	0	58.9	53.6	50.1	47.6
Leigh Barton		640	150	327	5(1)	0	58.8	55.6	50.0	47.3

* Hours $\leq 28^{\circ}F$ in brackets

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TABLE 2

ORCHARD YIELDS, PERCENTAGE FRUIT SETS AND ACCUMULATED TEMPERATURES AT EACH STAGE

Station	Fruit set	Yield	Bud burst to mouse ear		Mouse ear to 10% blossom		Bud burst to 10% blossom		10% blossom to full blossom		Bud burst to full blossom		Full blossom to 10% petal fall		Bud burst to 10% petal fall		10% petal fall to full petal fall		Bud burst to full petal fall		1968 Data Bud burst to full petal fall	
	%	Bushels	Accum Temp.	Days	Accum Temp.	Days	Accum Temp.	Days	Accum Temp.	Days	Accum Temp.	Days	Accum Temp.	Days	Accum Temp.	Days	Accum Temp.	Days	Accum Temp.	Days	Accum Temp.	Days
Leckford 4	29	782	31	17	43	15	74	32	36	5	110	37	10	2	120	39	22	6	142	45	155	61
Framptons 4	20	747	16	7	48	20	64	27	89	12	153	39	11	2	164	41	37	8	201	37	143	62
Framptons 1	21	744	19	7	43	20	62	27	88	12	150	39	10	2	160	41	37	8	197	37	120	58
Leckford 5	17	708	31	17	40	15	71	32	36	5	107	37	10	2	117	39	21	6	138	45	150	61
Leigh Barton	7	640	15	6	93	30	108	36	11	6	119	42	31	7	150	49	65	13	215	62	159	69
Leckford 6	17	543	35	18	46	15	81	33	41	6	122	39	3	2	125	41	35	6	160	47	171	61
High Chimneys	12	520	17	9	89	28	106	37	30	9	136	46	11	3	147	49	41	10	188	59	152	69
Mockbeggar 2	4	320	33	8	63	25	96	33	44	3	140	36	6	1	146	37	34	10	180	47	131	49
Mockbeggar 1	7	270	36	8	65	24	101	32	42	5	143	37	9	1	152	38	44	9	196	47	-	50

Appendix

Temperatures in pollination period

B D Moreton in the "Closed Conference of Advisory Entomologists, Fruit Pests Working party" report issued in November 1969 quotes a table for 1968 and 1969 giving blossom period temperatures in 1969 for Stelling Minnis and Mockbeggar

This is completed for the other stations for 1969 in the following table:

Blossom period temperatures in 1969

		10%-80% fall	No. of days with Max ≥ 57	≥ 60	≥ 65	Mean Max.
Leckford **	4	9.5 to 20.5	11	6	2	61.0
	5	9.5 to 20.5	10	6	2	60.8
	6	11.5 to 23.5	12	9	4	62.9
Mockbeggar	1	9.5 to 18.5	9	7	3	62.9
	2	10.5 to 18.5	7	6	3	62.4
Framptons **	1	4.5 to 24.5	20	17	10	64.7
	4	4.5 to 24.5	18	17	9	64.5
Leigh Barton		14.5 to 30.5	12	10	3	59.6*
High Chimneys		15.5 to 30.5	12	10	3	59.8*

* estimated values included.

** estimated - 2 days before full petal fall.

In this table, Moreton is taken as the authority for 80% fall at Stelling Minnis and Mockbeggar; at Leckford and Framptons, 2 days before full petal fall was assumed as the 80% level.

Minor differences arose in values for Stelling Minnis - 10 instead of 9, and 3 insted of 5, because the maximum temperatures at the time (fireblight) were in some doubt. The value for Mockbeggar above 57° was found as 9 and not 8. It is noted that he quoted Mockbeggar 1 for 1968; possibly these maxima come from thermograph trace - according to our records, the maximum thermometer there was broken for some time in 1968.

KEY

× Bud burst

□ Mouse ear

○ 10% blossom

● Full blossom

△ 10% petal fall

▲ Full petal fall

14–5 Frost on 5 nights with

14hours ≤ 32°F

5hours ≤ 28°F

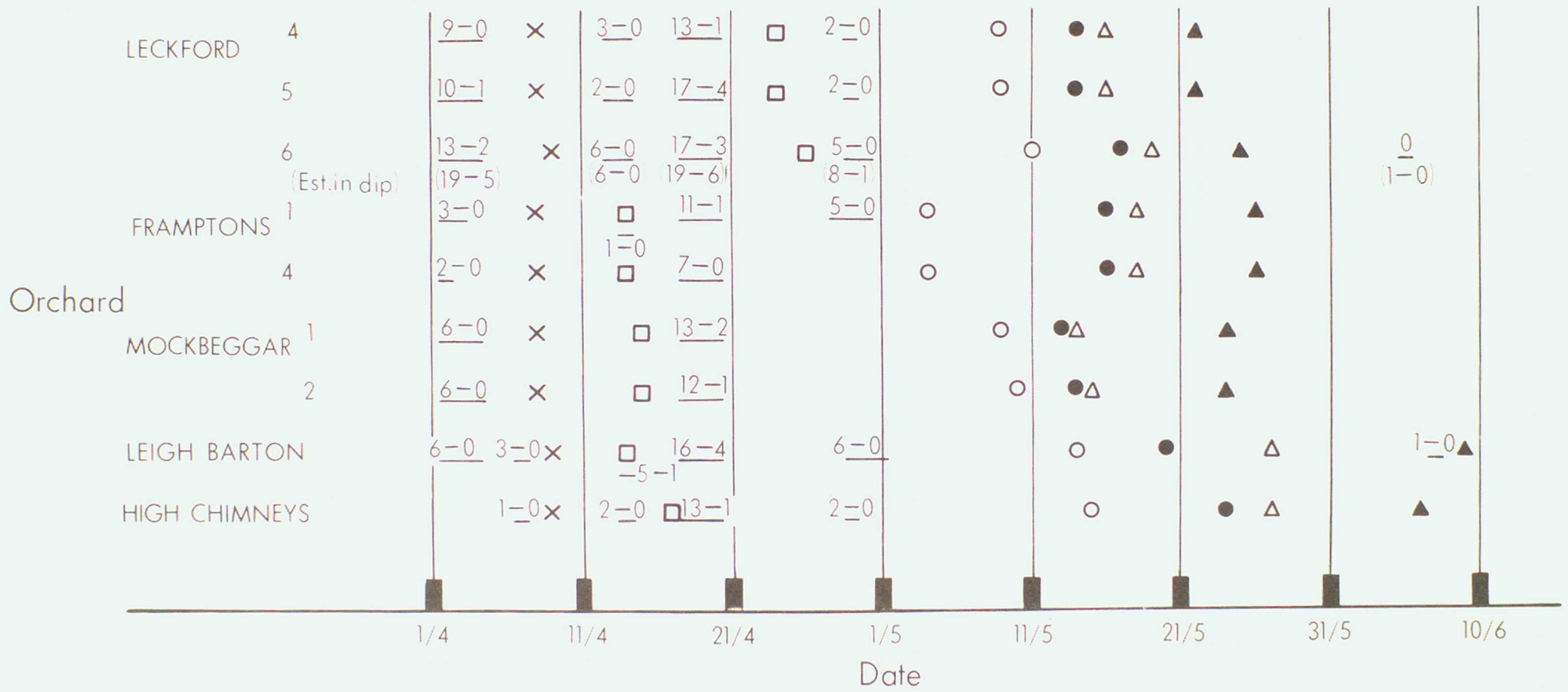

Figure 1 Development stages and frost periods—1969 orchard trials

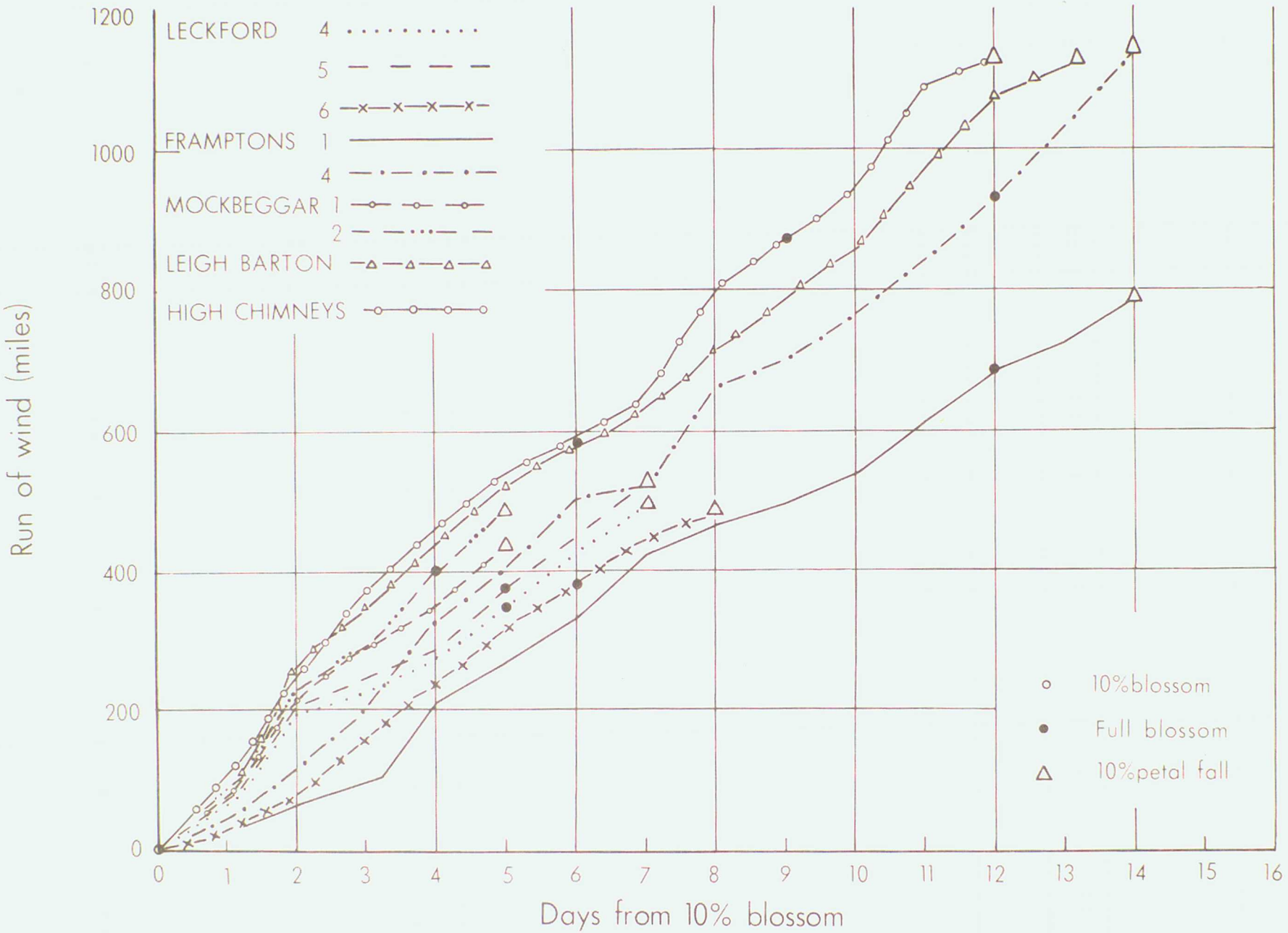

Figure 2 Daily run of wind 10% blossom to 10% petal fall